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Research Article

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Influence of agro-forestry system of guava + potato on potato production under changing climate

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Abstract

The field study was laidout during two consecutive years of 2013-14 and 2014-15 in the area of jurisdiction of C.S. Azad University of Agriculture and Technology, Kanpur. The *Rajpura, Baghauli, Jashrau, Adupura* and *Shaidpur* village of Mainpuri were selected for this study. The experimental soil was sandy loam, having poor plant nutrients status. The five varieties viz. K*ufri Jyoti, Kufri Jawahar, Kufri Pukhraj, Kufri Pushear* and *Kufri Ashoka* were selected for agro-forestry system with guava cv. L-49. The variation in guava fruits was found from 7.5 q/ha to 7.8 q/ha. The cultivars *Kufri Pukhraj* and *Kufri Jawahar* gave higher tubers yield by 365.00 q/ha and 363.00 q/ha under agro-forestry system of guava + potato cultivars *Kufri Puskar* and *Kufri Ashoka* yielded tubers almost equal by 330.00 q/ha and 328.00 q/ha respectively in guava + potato agro-forestry system. *Kufri Jyoti* produced lowest tubers by 281.00 q/ha in association of guava. The yield traits of cvs. potato were commensurable to the tubers yield of potato.

Keywords: Climate change, Environment, Guava, *Kufri Pukhraj* and *Kufri Jawahar*, Tuberization.

Introduction

Potato is a famous temperate crop and it is largely grown during the winter season in Uttar Pradesh. Its cultivation is mainly confined in Gangatic plain, where it is taken as autumn crop. Uttar Pradesh is the first largest potato producing state, grown on an average of 5.18 lakh hectare with production of 128.50 lakh mt. and productivity of 247.92 q/ha (Anonymous, 2010). The farmers of the South-Western-Semi-Arid Zone and Central Plain Zone of Uttar Pradesh especially in Agra,

Mainpuri, Farrukhabad, Kannauj and Kanpur districts, cultivate the early crop of potato for fetching market price. But higher temperature during early stage affects the growth and tuberization in early crop of potato. Hence, there was an urgent need to study the impact of raising temperature and CO_2 concentration on productivity of different early varieties of potato for achieving highest yield and fetching market price.

Since, the guava have short height with more branches provide shadow to the ground and maintain the normal temperature of environment, which is not affected to the filler crops grow between two rows of guava. In addition to this guava fruits give more income to the farm families. Therefore, a study was laidout to evaluate the impact of climate change on tuberization and productivity of early potato in riverine tract of Uttar Pradesh for adoption of suitable cultivars.

Materials and Methods

The present study was carried out during autumn of 2013-14 and 2014-15 in the area of jurisdiction of C.S. Azad University of Agriculture and Technology, Kanpur. The *Rajpura, Baghauli, Jashrau, Adupura* and *Shaidpur* village of Mainpuri were selected for this study. The texture of soil of experimental site was sandy loam. The soil contain pH 8.3, organic carbon 0.45%, total nitrogen 0.04%, available phosphorus 10 kg/ha and available potash 270 kg/ha, therefore, the fertility status of the plants nutrients was poor. The pH was determined by electrometric glass electrode method (Piper, 1950), while organic carbon was determined by colorimetric method (Datta, *et al.,* 1962). Total nitrogen was analyzed by Kjeldahl's method as described by Piper (1950). The available phosphorus and potassium were determined by Olsen's method (Olsen *et al*., 1954) and Flame photometric method (Singh, 1971), respectively. The average maximum and minimum temperature of South-Western-Semi-Arid Zone was noted 26.78 ºC and 12.00 ºC, respectively, during crops period. The five varieties viz., *Kufri Jyoti, Kufri Jwahar, Kufri Pukhraj, Kufri Pushkar* and *Kufri Ashoka* were selected for agro-forestry system with guava cv L.49. These varieties of potato cultivated extensively in potato growing tract of Uttar Pradesh as an early crop for fetching market price. The farmers were advocated to plant potato on first October at 50 cm apart in 10 rows between two rows of guava in every year, which was harvested on end of first fortnight of December. The 84% plant stand of potato was adjusted. The selected orchards of guava cv. L-49 was cleaned with deep inter-culture after harvesting of potato for obtaining the good matured fruits. The both enterprises were irrigated and protected from the incidence of insects, pest and disease as and when required. The five farmers from the selected villages of pilot area were selected for carrying out this study. The varieties wise data of selected villages collected and averaged. The results of study discussed on mean vale of two years.

Results and Discussion

The pooled results were recorded and presented in Table-1 and discussed here under appropriate heads:-

(A) Fruits yield of guava: The yield of guava fruits cv. L-49 was more, grown in U.P. conditions, and it is heavy bearing large sized fruits, crip pulp, soft and cream white, acidic-sweet, dwarf, spreading, good fruiting. Good keeping quality. Therefore, guava + potato agro-forestry displayed not much variation in productivity of guava fruits. The variation in guava fruits was found from 7.50 q/ha t 7.80 q/ha. The slightly higher productivity of guava fruits was noted under low productivity of potato tubers, while higher, productivity of potato tubers displayed the low productivity of fruits of guava. The high yielder potato varieties uptake the plant nutrients more from soil in comparison to low yielder potato cultivars. This was the major reason for higher and lower fruits yield of guava. These results are in agreement with those of Singh (2007), Singh (2011), Singh *et al.* (2011), Singh *et al.* (2011) and Singh *et al*. (2016).

Table-1: Yield traits of potato, tubers yield of potato and fruits yield of guava under different system of agro-forestry.

(Pooled data of two years)

S. N.	Agro-forestry system	Yield traits of potato			Potato tubers yield (q/ha)			Fruits yield of guava (q/ha)		
		Tubers/ plant	Diameter of tuber (cm)	Weight of tubers/plant (g)	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled
1.	Guava+Kufri Jyoti	4.90	4.15	280.80	287.00	275.00	281.00	7.65	7.95	7.80
2.	Guava+Kufri Jawahar	6.10	4.38	311.85	367.00	359.00	363.00	7.40	7.60	7.50
3.	Guava+Kufri Pukhraj	6.38	4.48	324.05	367.00	363.00	365.00	7.40	7.60	7.50
4.	Guava+Kufri Puskar	5.64	4.25	300.85	332.00	328.00	330.00	7.45	8.05	7.75
5.	Guava+Kufri Ashoka	5.25	4.22	298.95	330.00	326.00	328.00	7.45	8.15	7.80
	S.E. (m+)	0.14	0.07	9.20	3.68	3.69	3.61	-	-	-
	C.D. 5%	0.29	0.14	18.84	7.53	7.67	7.39	-	-	-

Note: Fruits yield of guava was taken between ages of 5 to 7 year at initial fruiting stage.

(B) Yield contributing traits of potato: Among the five varieties of potato under study, cultivars – *Kufri Pukhraj* registered a maximum tubers/plant of 6.38 over other varieties. *Kufri Jawahar* produced statistically at par tubers/plant (6.10) with *Kufri Pukhraj,* K*ufri Jyoti, Kufri Puskar* and *Kufri Ashoka* produced almost equal number of tubers/plant. The maximum average diameter of tuber measured under cv. *Kufri Pukhraj* (4.48 cm) closely followed by *Kufri Jawahar* (4.38 cm). *Kufri Puskar, Kufri Ashoka* and *Kufri Jyoti* displayed the average diameter of tuber by 4.25 cm, 4.22 cm and 4.15 cm, respectively. The maximum tuber weight/plant weighed under *Kufri Pukhraj* (324.05 g) followed by *Kufri Jawahar* (311.85 g). *Kufri Puskar* produced tubers yield/plant by 300.85 g while *Kufri Ashoka* and *Kufri Jyoti* gave tubers yield/plant by 298.95 g and 280.80 g, respectively. These findings are in agreements with those reported by Singh *et al*. (2016).

(C) Tuber yield (q/ha): It is evident from the data summarized in Table-1 that under climate change *Kufri Pukhraj* and *Kufri Jawahar* gave higher tubers yield by 365.00 q/ha and 363.00 q/ha. Cultivars *Kufri Puskar* and *Kufri Ashoka* yielded tubers almost equal by 330.00 q/ha and 328 q/ha, respectively. *Kufri Jyoti* produced lowest tubers by 281.00 q/ha. These findings confirm the results of Singh *et al*. (2016). The decrease in tubers productivity of cv. *Kufri Jyoti, Kufri Ashoka* and *Kufri Pusakar* in comparison to *Kufri Jawahar* and Kufri *Pukhraj* was due to higher optimum temperature at its growth stage. But this period was most favourable for growth of cvs. Kufri Jawahar and *Kufri Pukhraj* because early sowing of these cultivars offset the climate effect on tubers productivity. Thus the early plantation of *Kufri Pukhraj* and *Kufri Jawahar* is the better option for farmers to compensate the yield losses of potato tubers under climate in guava + potato agro-forestry system. The cultivars *Kufri Jawahar* and *Kufri Pukhraj* had maintained better source-sink relationship. It means amount of dry matter of photosynthesis produced by source organs trans-located toward sink organ (economic part) and produced higher tubers yield. The aforementioned varieties of potato had higher number of tubers/plant means at possessed higher sink capacity to utilized the photo assimilates trans-located from source. It, resulted in higher number of tubers/plant and more average tubers yield. The results commensurable to the findings of Panwar *et al.* (1986), Srivastava and Bahrdwaj (1986), Pachper and Shete (2010), Singh *et al*. (2015), Singh *et al*. (2015) and Singh *et al*. (2016).

Conclusion and Recommendation

In potato growing tract of Uttar Pradesh, the guava orchards are more area but no crops grown under the rows spacing of guava as a filler crops. Majority of farmer's plant early potato for fetching good market price. Therefore, the farmers of this tract may be advocated for planting of *Kufri Pukhraj* and *Kufri Jawahar* as filler crop under agro-forestry system and harvest the fruits of newly generated technology.

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